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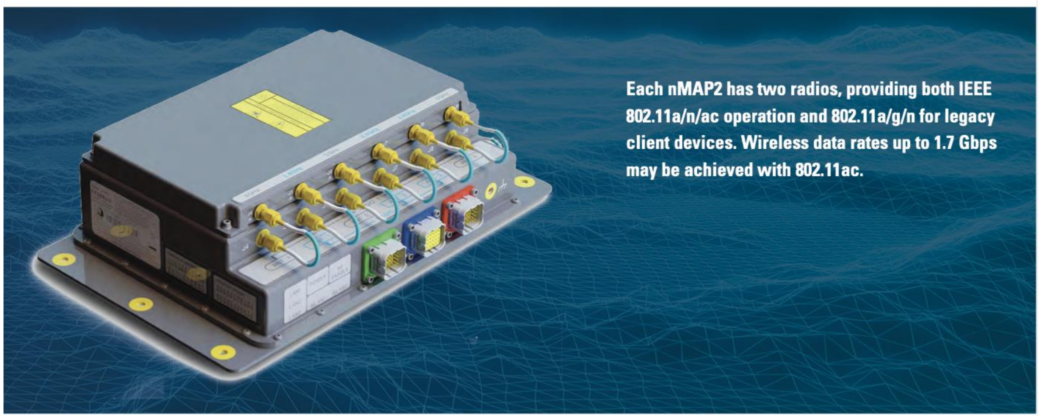
U.S. Pat. No. 6,917,304 v. Miltope

Claim Language	nMAP2 Multifunction Access Point (“Accused Product/device”)
1. A method of wireless transmission of data in digital and/or analogue format through a communications channel from at least two data sensors to a data processing means said method comprising the step of division of said channel into sub-channels and transmitting said data from said data sensors respectively though said sub-channels accordingly; characterized by	The Accused Product practices a method for wireless transmission of data in digital format through a communications channel, for example, the channel between 2.4 GHz and approximately 5 GHz frequency band, among other bands. WIRELESS **nMAP2** 802.11ac MULTIFUNCTION ACCESS POINT  https://mymiltope.com/wp-content/uploads/2020/07/Miltope_nMAP2_Cut_Sheet.pdf **IEEE802.11ac WIRELESS FEATURING COGNITIVE HOTSPOT (CHT) TECHNOLOGY** nMAP2's are aware of their environment and adapt to cabin environments. By exchanging information with neighboring nMAP2's, they manage available resources, prevent interference, and balance the wireless network. Settings to guarantee QoS and improve overall capacity are available. Two modes of operation are supported: Access Point (CWLU) mode allows clients to connect to aircraft LAN via intelligent bridging. Access Controller (Enhanced CWLU) mode adds DHCP server with routing, traffic control, and prioritization for different user VLANS or traffic to CWLU operation. **nMAP2 Features and Functions:** • 5" Integrated or detached antenna assembly reduces cost, weight, & size • Intelligent client roaming • Auto wireless power control • Auto channel assignment • Auto Load Balancing & Interference Mitigation • Automatic Failure Recovery • The latest advanced end to end network security • Radio certifications for legal nMAP2 operation • Up to 16 concurrent profiles & 64 VLANs (IEEE 802.1q) for separate user networks • Configurable and guaranteed QOS per profile • Mutual authentication via PEAP, EAP-FAST, EAP-TLS, EAP-TTLS, or EAP-SIM) https://mymiltope.com/wp-content/uploads/2020/07/Miltope_nMAP2_Cut_Sheet.pdf

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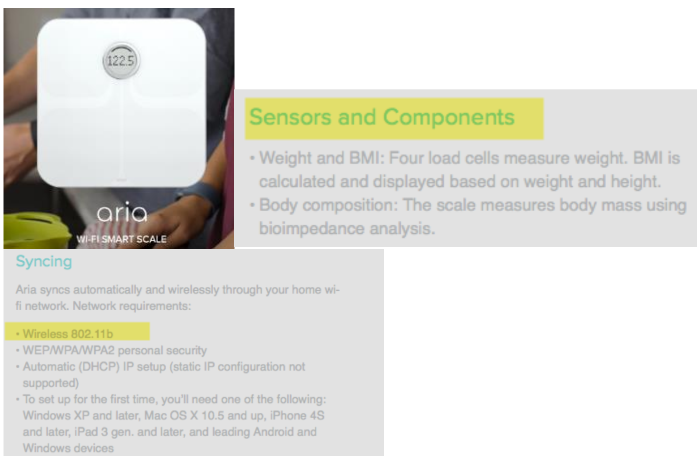
Data is transmitted through the communications channel (the 2.4 GHz frequency spectrum), at least during internal testing and use, from at least two data sensors to a data processing means, e.g., one or more processing units in the Accused Device. On information and belief, the Accused Device includes processing units that perform its intended function(s).

For example, the network may include a local data sensor (e.g., a weight, impedance, temperature, air pressure, and humidity sensors) located on an 802.11g device that communicates with the Accused Product's 2.4 GHz communications channel. The 802.11g devices necessarily require a lower throughput than 802.11n devices because the 802.11g standard has a maximum throughput that is substantially lower than the throughput allowable using 802.11n.

Exemplary 802.11g device with weight and impedance sensors:



https://www.fitbit.com/aria.

Additional exemplary 802.11g sensors include wireless temperature, air pressure, and humidity sensors.
http://www.omega.com/pptst/wSeries.html

The network, at least during internal testing and use, may in addition include a second data sensor (e.g., camera sensor as shown in the exemplary 802.11n device below) located on a 802.11n device that also communicates with the Accused Device's 2.4 GHz communications channel. These devices using the 802.11n standard have a higher throughput than is allowed under the 802.11g standard.

Exemplary 802.11n device with a digital camera and accompanying image sensor (e.g., CMOS, CCD, and other variations):

EXHIBIT 2

<table>
<tr>
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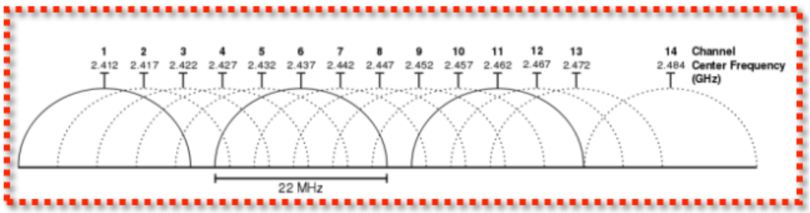
The cream of the current Fire OS tablet crop, the 8.9-inch device first launched in Sept 2013, and was refreshed this September. with a starting sticker price of $429 USD. It packs a 2,560 x 1,600 pixel display, a Qualcomm Inc. (QCOM) Snapdragon 805 chip (quad-core, 2.5 GHz), 2 GB of LPDDR3, and 802.11n Wi-Fi.

http://bit.ly/1Ylj6Bd

The Accused Product comprises a multiplexer adapted to effect division of the communications channel into sub-channels, e.g., in the Accused Product the 2.4 GHz frequency spectrum is divided into communications channels for 802.11g, and communications channels for 802.11n. For example, there are 14 sub-channels within the 2.4 GHz band. (See below).

Channels 1, 6, and 11

First of all, let's talk about 2.4GHz, because as of the start of 2015, almost all WiFi installations still use the 2.4GHz band. 802.11ac, which debuted in 2013, is driving adoption of 5GHz — but thanks to backwards compatibility and dual-radio routers and devices, 2.4GHz will continue to reign for a while.



All of the versions of WiFi up to and including 802.11n (a, b, g, n) operate between the frequencies of 2400 and 2500MHz. These paltry 100MHz are separated into 14 channels of 20MHz each. As you've probably worked out, 14 lots of 20MHz is a lot more than 100MHz — and as a result, every 2.4GHz channel overlaps with at least two (but usually four) other channels (see diagram above). As you can probably imagine, using overlapping channels is bad — in fact, it's the primary reason for awful throughput on your wireless network.

http://www.extremetech.com/computing/179344-how-to-boost-your-wifi-speed-by-choosing-the-right-channel
</td>
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<tr>
<td>a) said step of division of said communications channel being effected asymmetrically whereby</td>
<td>
The Accused Device is configured to be adapted to divide the 2.4 GHz frequency spectrum asymmetrically. The table below summarizes the how the Accused Device uses modulation and coding rate to determine how data is sent using the 2.4 GHz communications channel.

<u>*Modulation scheme and coding rate for 802.11g:*</u>
</td>
</tr>
</table>

EXHIBIT 2

the data carrying capacities of said sub-channels are unequal; and

Symbol duration = 4 µs

Data-carrying sub-carriers = 48

Coded bits / sub-carrier = 6 (64 QAM)

Coded bits / symbol = 6 x 48 = 288

Data bits / symbol: 3/4 x 288 = 216 bits/symbol

=> bit rate = 216 bits / 4 µs = 54 Mb/s

http://www.polytech2go.fr/topnetworks/lectures/book16pe1.pdf

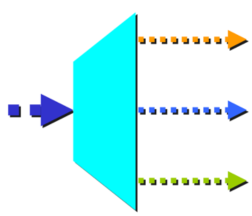
Modulation scheme and coding rate for 802.11n:

MCS Index	Type	Coding Rate	Spatial Streams	Data Rate (Mbps) with 20 MHz CH		Data Rate (Mbps) with 40 MHz CH	
				800 ns	400 ns (SGI)	800 ns	400 ns (SGI)
0	BPSK	1 / 2	1	6.50	7.20	13.50	15.00
1	QPSK	1 / 2	1	13.00	14.40	27.00	30.00
2	QPSK	3 / 4	1	19.50	21.70	40.50	45.00
3	16-QAM	1 / 2	1	26.00	28.90	54.00	60.00
4	16-QAM	3 / 4	1	39.00	43.30	81.00	90.00
5	64-QAM	2 / 3	1	52.00	57.80	108.00	120.00
6	64-QAM	3 / 4	1	58.50	65.00	121.50	135.00
7	64-QAM	5 / 6	1	65.00	72.20	135.00	150.00
8	BPSK	1 / 2	2	13.00	14.40	27.00	30.00
9	QPSK	1 / 2	2	26.00	28.90	54.00	60.00
10	QPSK	3 / 4	2	39.00	43.30	81.00	90.00
11	16-QAM	1 / 2	2	52.00	57.80	108.00	120.00
12	16-QAM	3 / 4	2	78.00	86.70	162.00	180.00
13	64-QAM	2 / 3	2	104.00	115.60	216.00	240.00
14	64-QAM	3 / 4	2	117.00	130.00	243.00	270.00
15	64-QAM	5 / 6	2	130.00	144.40	270.00	300.00
16	BPSK	1 / 2	3	19.50	21.70	40.50	45.00
...	...	...	...	...	...	...	...
31	64-QAM	5 / 6	4	260.00	288.90	540.00	600.00

http://airmagnet.flukenetworks.com/assets/whitepaper/WP-802.11nPrimer.pdf

Both 802.11g and 802.11n traffic is handled through an OFDM (orthogonal frequency division multiplexing) multiplexing scheme whereby data in a communication channel is split into N parallel data streams or multiple "subcarriers" (i.e., sub-channels). The OFDM scheme for the 802.11n standard allows for the 802.11n to handle higher data rates than 802.11g and earlier standards.

An OFDM system takes a data stream and splits it into N parallel data streams, each at a rate 1/N of the origin rate.



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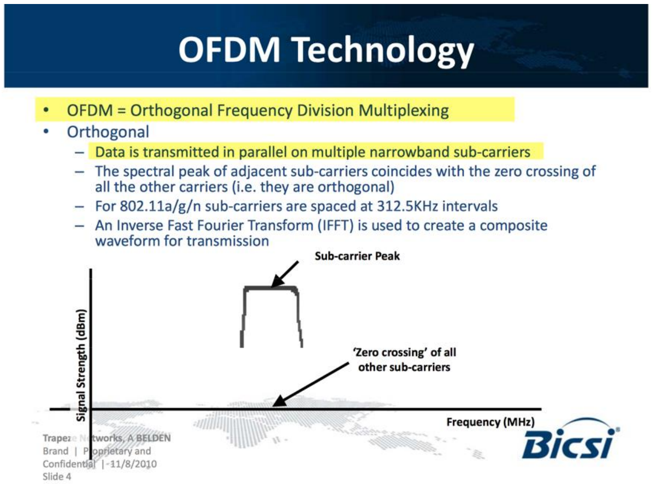
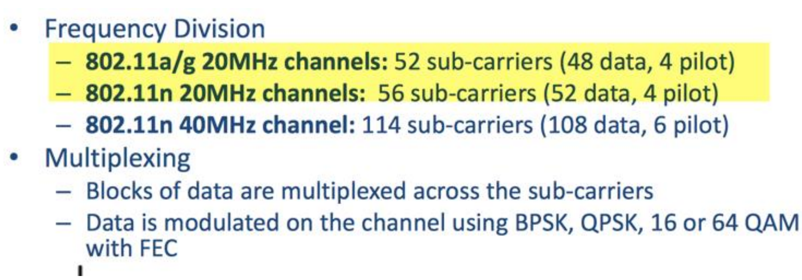
http://www.polytech2go.fr/topnetworks/lectures/book16pe1.pdf



https://www.bicsi.org/uploadedfiles/PDFs/Conferences/singapore2010/day2/2.8%20802.11n%20Deployment%20-%20Alfred%20Chan,%20Trapeze.pdf

The communications channel is divided asymmetrically whereby data-carrying capacity of the sub-channels are unequal. 802.11g (20 MHz channel) data is divided into 52 sub-carriers (sub-channels) and 802.11n (20 MHz channel) data is divided into 56 sub-carriers (sub-channels). Using the 20MHz channel for 802.11n allows connection with legacy devices using 802.11a/g 20 MHz channels.



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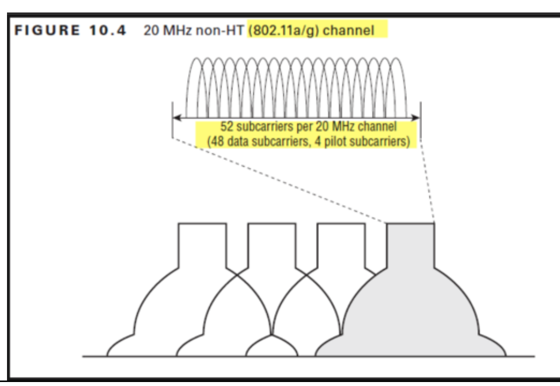

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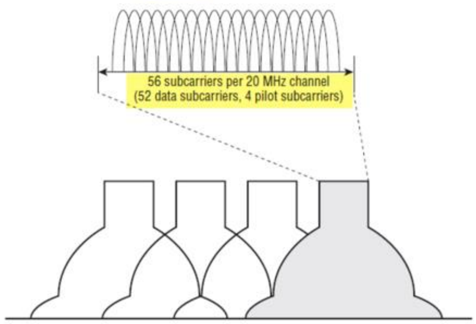
FIGURE 10.5 20 MHz HT (802.11n) channel



http://mrncciew.com/2014/10/19/cwap-802-11n-introduction/

The data-carrying capacity of the sub-channels are unequal -- 802.11g has a maximum data rate of 54 Mb/s and 802.11n has a maximum data rate of about 300 Mb/s.

MCS Index	Type	Coding Rate	Spatial Streams	Data Rate (Mbps) with 20 MHz CH		Data Rate (Mbps) with 40 MHz CH	
				800 ns	400 ns (SGI)	800 ns	400 ns (SGI)
0	BPSK	1 / 2	1	6.50	7.20	13.50	15.00
1	QPSK	1 / 2	1	13.00	14.40	27.00	30.00
2	QPSK	3 / 4	1	19.50	21.70	40.50	45.00
3	16-QAM	1 / 2	1	26.00	28.90	54.00	60.00
4	16-QAM	3 / 4	1	39.00	43.30	81.00	90.00
5	64-QAM	2 / 3	1	52.00	57.80	108.00	120.00
6	64-QAM	3 / 4	1	58.50	65.00	121.50	135.00
7	64-QAM	5 / 6	1	65.00	72.20	135.00	150.00
8	BPSK	1 / 2	2	13.00	14.40	27.00	30.00
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31	64-QAM	5 / 6	4	260.00	288.90	540.00	600.00

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http://www.polytech2go.fr/topnetworks/lectures/book16pe1.pdf

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<table>
<tr>
<td>b) the data rate required for data transmission from said local sensors differing substantially between said at least two sensors; and</td>
<td>
The accused product is 802.11g/n compliant and therefore is configured to adapt to both types of sensors, one which has 802.11g capability and the other which has 802.11n capability. The local data sensors (e.g., sensor(s) of the exemplary 802.11g device shown below, sensor(s) of the exemplary 802.11n device) to groups of sub-channels in accordance with different data rate requirements from the local sensors.

Exemplary 802.11g device with weight and impedance sensors:

Sensors and Components
• Weight and BMI: Four load cells measure weight. BMI is calculated and displayed based on weight and height.
• Body composition: The scale measures body mass using bioimpedance analysis.
Syncing
Aria syncs automatically and wirelessly through your home wi-fi network. Network requirements:
• Wireless 802.11b
• WEP/WPA/WPA2 personal security
• Automatic (DHCP) IP setup (static IP configuration not supported)
• To set up for the first time, you'll need one of the following: Windows XP and later, Mac OS X 10.5 and up, iPhone 4S and later, iPad 3 gen. and later, and leading Android and Windows devices
https://www.fitbit.com/aria. Additional exemplary802.11g sensors include wireless temperature, air pressure, and humidity sensors. http://www.omega.com/pptst/wSeries.html

The network, at least during internal testing and use, may in addition include a second data sensor (e.g., camera sensor as shown in the exemplary 802.11n device below) located on a 802.11n device that also communicates with the Accused Device's 2.4 GHz communications channel. These devices using the 802.11n standard have a higher throughput than is allowed under the 802.11g standard.

Exemplary 802.11n device with a digital camera and accompanying image sensor (e.g., CMOS, CCD, and other variations):


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http://bit.ly/1Ylj6Bd

For example, when an 802.11g device communicates with the Accused Product, because the device can only send data at the data rate of the slower 802.11g standard, the Accused Product assigns the 802.11g device to an 802.11g channel. 802.11g data is allocated to the 48 data sub-channels (see
</td>
</tr>
</table>

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below) in accordance with the data rate requirements of the 802.11g device's sensor, with 54 Mbps being the maximum data rate allocable to the 802.11 g device.

Symbol duration = 4 μs

Data-carrying sub-carriers = 48

Coded bits / sub-carrier = 6 (64 QAM)

Coded bits / symbol = 6 x 48 = 288

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=> bit rate = 216 bits / 4 μs = 54 Mb/s

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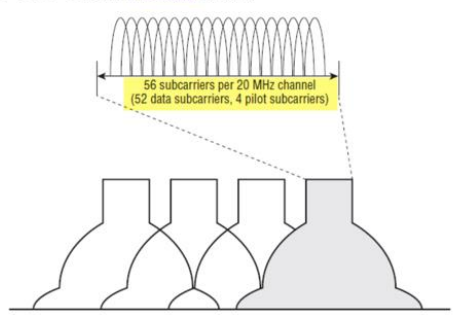
For example, when an 802.11n device communicates with the Accused Product, because the device can send data at the substantially higher data rate of the 802.11n standard, the Accused Product assigns the 802.11n device to an 802.11n channel. 802.11n data (from e.g., the 802.11n device's video sensor) is allocated to 52 sub-channels (see below) in accordance with the data rate requirements of the 802.11n device's sensor, with 300 Mbps being the maximum data rate allocable to the 802.11n device.

FIGURE 10.5 20 MHz HT (802.11n) channel



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The data-carrying capacity of the sub-channels are unequal -- 802.11g has a maximum data rate of 54 Mb/s and 802.11n has a maximum data rate of 300 Mb/s.

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MCS Index	Type	Coding Rate	Spatial Streams	Data Rate (Mbps) with 20 MHz CH		Data Rate (Mbps) with 40 MHz CH	
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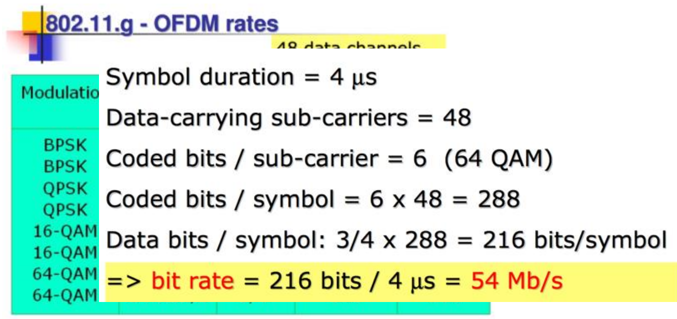
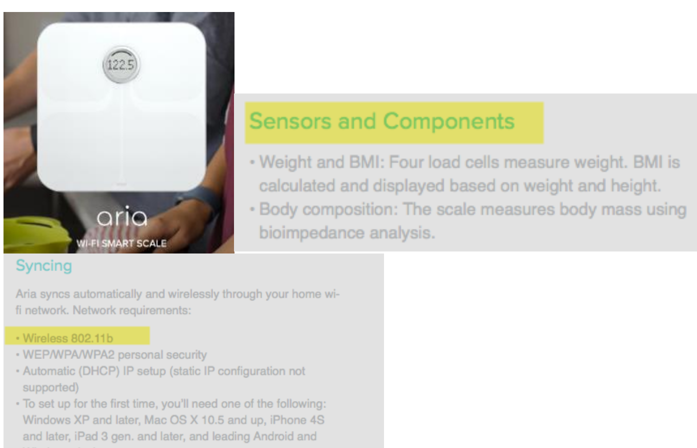


http://www.polytech2go.fr/topnetworks/lectures/book16pe1.pdf

c) allocating data from said local data sensors to respective ones or groups of said sub-channels in accordance with the data carrying capacities of said sub-channels.

The Accused Product is configured to allocate data from said local data sensors (e.g., sensor(s) of the exemplary 802.11g device shown below, sensor(s) of the exemplary 802.11n device) to groups of sub-channels in accordance with different data rate requirements from the local sensors.

Exemplary 802.11g device with weight and impedance sensors:



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The network, at least during internal testing and use, may in addition include a second data sensor (e.g., camera sensor as shown in the exemplary 802.11n device below) located on an 802.11n device that also communicates with the Accused Device's 2.4 GHz communications channel. These devices using the 802.11n standard have a higher throughput than is allowed under the 802.11g standard.

Exemplary 802.11n device with a digital camera and accompanying image sensor (e.g., CMOS, CCD, and other variations):

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For example, when an 802.11g device communicates with the Accused Product, because the device can only send data at the data rate of the slower 802.11g standard, the Accused Product assigns the 802.11g device to an 802.11g channel. 802.11g data is allocated to the 48 data sub-channels (see below) in accordance with the data rate requirements of the 802.11g device's sensor, with 54 Mbps being the maximum data rate allocable to the 802.11 g device.

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For example, when an 802.11n device communicates with the Accused Product, because the device can send data at the substantially higher data rate of the 802.11n standard, the Accused Product assigns the 802.11n device to an 802.11n channel. 802.11n data (from e.g., the 802.11n device's video sensor)

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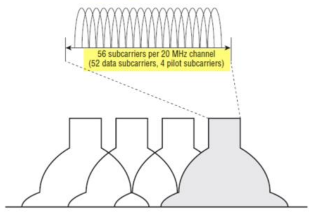
is allocated to 52 sub-channels (see below) in accordance with the data rate requirements of the 802.11n device's sensor, with 300 Mbps being the maximum data rate allocable to the 802.11n device.

FIGURE 10.5 20 MHz HT (802.11n) channel



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5	64-QAM	2 / 3	1	52.00	57.80	108.00	120.00
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7	64-QAM	5 / 6	1	65.00	72.20	135.00	150.00
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9	QPSK	1 / 2	2	26.00	28.90	54.00	60.00
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13	64-QAM	2 / 3	2	104.00	115.60	216.00	240.00
14	64-QAM	3 / 4	2	117.00	130.00	243.00	270.00
15	64-QAM	5 / 6	2	130.00	144.40	270.00	300.00
16	BPSK	1 / 2	3	19.50	21.70	40.50	45.00
...	...	...	...	...	...	...	...
31	64-QAM	5 / 6	4	260.00	288.90	540.00	600.00

http://airmagnet.flukenetworks.com/assets/whitepaper/WP-802.11nPrimer.pdf

802.11.g - OFDM rates

48 data channels

Modulation	Bit rate	Coding rate	Coded bits / symbol	Data bits / symbol
BPSK	6 Mbit/s	1/2	48	24
BPSK	9 Mbit/s	3/4	48	36
QPSK	12 Mbit/s	1/2	96	48
QPSK	18 Mbit/s	3/4	96	72
16-QAM	24 Mbit/s	1/2	192	96
16-QAM	36 Mbit/s	3/4	192	144
64-QAM	48 Mbit/s	2/3	288	192
64-QAM	54 Mbit/s	3/4	288	216

http://www.polytech2go.fr/topnetworks/lectures/book16pe1.pdf